does occur. According to my experience, it is worth the trouble to give even such large bodies as the human, as much soaking occasionally as is practicable, in such a solution as I have just described. This should be done between class periods, at least twice a week, when the air of the room is at all dry.

When material comes to my hands already filled with formalin, I soak it in running water, for a number of hours, according to its size, to get rid of the formalin, before transferring it to a phenol-glycerine solution.

Material which has been thus prepared with a phenol-glycerine solution can be stored or shipped in airtight wrappings with no surrounding solution. In an important article on methods for preserving and storing cadavers Keiller[2] has described methods for preparing wrappings.

I have adopted the practise of shipping material, which has been thoroughly soaked in the dilute embalming fluid described in this article, in packages well wrapped and packed in excelsior. No fluid except that in the specimen is needed for a number of weeks, even in summer, if the packing is well done. There is much economy in weight, and expensive containers are not needed.

In some medical schools, cadavers are stored in airtight chambers with no fluid except for a dish of alcohol which keeps the atmosphere of the chamber saturated with alcohol fumes. This is the best of all storage methods that have come to my attention, for properly embalmed bodies, and it works well with other large vertebrates. I have found it successful in a warm climate, and I have never heard any criticism of the method by people who have tried it.

Much trouble from drying of material in the dissecting room can be avoided by keeping the air of the room very humid. Professor S. W. Ranson, Northwestern University Medical School, has called my attention to a device which he has found efficient in maintaining a humid atmosphere and which eliminates the drying troubles. This is the "Steamo Air Moistener," which can be obtained from "The Air Moistener Co.," 28 North Market St., Chicago. It is attached to steam radiators of various types. Directions are furnished for maintaining any desired percentage of humidity.

[2] *Philadelphia Medical Jour.*, December 29, 1900.

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SCIENTIFIC BOOKS

Physical Chemistry of Vital Phenomena for Students and Investigators in the Biological and Medical Sciences. By J. F. MCCLENDON, Assistant Professor of Physiology in the University of Minnesota. Princeton University Press, 1917.

In this concise book of less than 200 pages of text Professor McClendon describes and discusses briefly some of the more recent applications of physical chemistry to the analysis of vital phenomena. The field, although no longer new, is very large and calls for much further investigation; hence finality is scarcely possible at present, and the author describes his purpose as largely practical and tentative: "to develop a tool for physiological research," rather than to produce a systematic treatise on the subject. The space assigned to the different topics under discussion is very unequal; many of these are presented in the barest summary, with little attempt to reconcile conflicting statements or to reach unifying conclusions; while others, particularly those in which the author's own chief researches have been made, are treated in considerable detail. The book is intended for advanced students and presupposes more than elementary biological and chemical knowledge in the reader; condensation is carried to an extreme, and in many places one receives the impression of a succession of abstracts, in which both the selection and the omission of material seem arbitrary. In the later chapters, which deal with the more specifically biological topics (amœboid movement, tropisms, cell-division, fertilization, muscular contraction, oxidation, production of light and heat), the space is quite insufficient for adequate discussion, and the ac-

count is condensed to a bare outline of the facts and points of view which the author considers important. At the end there is an appendix on the general chemical composition of organisms, followed by a large and varied literature list and an index of topics with the names of the authors of the chief papers. Much of the book thus forms a summary of recent research, and will be valuable to those desiring a record of progress in this field and a guide to the literature of its various departments.

The most original chapters are those relating to the determination of hydrogen-ion concentrations and the electromotor and osmotic properties of partitions, and here there is much that is ingenious, independent and suggestive. The author's improved methods for determining the H-ion concentration of blood are described in detail, with figures of apparatus and a useful chart for converting potentials into H-ion exponents. The use of indicators and buffer mixtures is also explained, and many valuable data are given in convenient form. The account of semi-permeable and porous partitions is especially timely and interesting; the phenomena of membrane-potentials, negative osmose and cell-permeability are described, and their relations to the physiological processes of secretion, absorption and stimulation are discussed in a clear and definite manner. The author supports the view that the bioelectric variations of potential are primarily the expression of variations in the osmotic and hence the electromotor properties of the protoplasmic surface-layers or plasma-membranes. Agents like salts, anæsthetics and cytolytic substances are regarded as producing their characteristic effects by modifying the condition of the plasma-membranes.

As a whole the book exhibits the defects as well as the merits of its extreme brevity and condensation. The author evidently wishes to be as concise as possible, and largely for this reason his discussion and statements of fact frequently appear dogmatic and lacking in much-needed qualifications. Certain explanations are incomplete or otherwise open to criticism. Thus to regard negative osmose as essentially a case of electrical endosmose seems inaccurate; in true electrical osmose both the solution and the porous partition are interposed as parts of an electrical circuit, and the energy for the transport is derived from a battery or other external source; while in negative osmosis the water passes spontaneously through the porous partition from the more concentrated to the more dilute solution. Certain diffusion processes offer a closer analogy; recent investigation has shown that when the partition consists of negatively charged material like porcelain negative osmose occurs in the case of those electrolytes whose anions diffuse more rapidly than their cations; and it seems preferable to regard the positively charged layer of water adjoining the surfaces of the pores as acting like a layer of cations and as being carried after the rapidly diffusing anions by electrostatic attraction. The phenomenon seems indeed to afford further evidence of the hydration of ions in solution. Exception may also be taken to the following statements: suspensoids do not exert osmotic pressure (p. 72); monovalent and bivalent cations are antagonistic to each other in the precipitation of colloids (p. 77); surface-active substances are repelled by water molecules (p. 66); in anæsthesia adsorption is at the basis of the whole matter (p. 140. N. B.: this seems contradicted by the positive temperature-coefficients of narcosis with chloral and alcohol as observed by Meyer); the sperm need only scratch the egg-surface to make it segment (p. 158); local reduction of surface-tension produces protrusion of the affected surface (p. 148). This last statement especially needs qualifying; it can be true only when the surface-tension equilibrates some other force (such as gravity), which of itself tends to cause outflow or protrusion of fluid. The force of surface-tension acts tangentially, hence the surface-layer of fluid must always tend to be drawn toward the regions where the tension is highest; this removal of fluid from the areas of lower surface-tension must (unless otherwise compensated) cause there *depression* instead of protrusion, as seen for instance in the case of a layer of water to which ether or alcohol

is locally applied. In the case of any curved surface, *e. g.*, of a suspended drop of fluid, the tangentially acting force due to surface-tension must similarly tend to draw the surface-fluid away from any area where the tension is locally lowered; for geometrical reasons this lateral traction is necessarily greater than the externally directed force acting on the surface-fluid at the same area—due to the radial component of surface-tension which compresses the drop and tends to cause outflow at that area; hence in this case also the surface-layer of fluid will tend to be withdrawn from regions of lower and heaped up at regions of higher surface-tension. If the drop is in contact with a solid, such displacements may by reaction cause movements of the drop as a whole. The author's account of the mechanics of amœboid movement and cell-division needs to be reconsidered, since he assumes throughout that protrusion or outflow always takes place at regions of lowered surface-tension.

The whole subject, however, is full of debatable questions, and in his preface the author expressly defers judgment upon most of these, urging that the present need is for further investigation rather than for theoretical discussion. Most of us will readily grant this, and it is as an aid to investigation that the present manual will find its chief usefulness.

The reviewer feels bound to point out that the book suffers greatly from carelessness in composition and proofreading. The responsibility for this is not the author's alone. A University Press should be careful to maintain high standards in such matters.

RALPH S. LILLIE

THE PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES

THE seventh number of Volume 3 of the *Proceedings of the National Academy of Sciences* contains the following articles:

The Cayleyan Curve of the Quartic: Teresa Cohen, Johns Hopkins University.

A Search for an Einstein Relativity-Gravitational Effect in the Sun: Charles E. St. John, Mount Wilson Solar Observatory, Carnegie Institution of Washington. A series of observations stretching over several years indicates that the Einstein effect does not exist.

Triads of Transformations of Conjugate Systems of Curves: Luther Pfahler Eisenhart, department of mathematics, Princeton University.

The Molecular Weights of the Triarylmethyls: M. Gomberg and C. S. Schoepfle, Chemical Laboratory, University of Michigan. After discussing factors influencing dissociation and the relation between dissociation and the nature of the aryl groups, seven triphenylmethyls are investigated in detail and various inferences are drawn from the graphs of their dissociations against their concentrations.

Sex-Determination and Sex-Differentiation in Mammals: Frank R. Lillie, department of zoology, University of Chicago. Discussion of the results of studies of the anatomy of twenty-two fetal free-martins ranging in size from 7.5 to 28 cm. Sex determination in mammals is not irreversible predestination; with known methods and principles of physiology we can investigate the possible range of reversibility.

The Crystal Structure of Magnesium: A. W. Hull, Research Laboratory, General Electric Company, Schenectady. The structure is analyzed by means of X-ray.

The Structure of High-Standing Atolls: W. M. Davis, department of geology, Harvard University. Attention is drawn to the relation of atoll limestones to their supposed foundation of volcanic rocks. The relative merits of the glacial-control theory and of Darwin's theory are discussed.

Studies of Magnitude in Star Clusters, VII. A Method for the Determination of the Relative Distances of Globular Clusters: Harlow Shapley, Mount Wilson Solar Observatory, Carnegie Institution of Washington. The median magnitude of short period variables is constant in each cluster and may be used to determine the distance of the cluster which, with one or two exceptions, is found to be greater than 30,000 light-years.

The Principal Axes of Stellar Motion: H. Raymond, Dudley Observatory, Albany, New